CLEAN, FLOWING WATERS FOR WASHINGTON

The Center for Environmental Law & Policy

February 3, 2017

Via Email Only

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RE: Draft NPDES Permit for the Leavenworth National Fish Hatchery (WA0001902)

Dear Mss. Psyk, Nogi, and Wu:

The following comments are offered on behalf of Wild Fish Conservancy (WFC) and the Center for Environmental Law and Policy (CELP) on the draft National Pollutant Discharge Elimination System (NPDES) permit for the Leavenworth National Fish Hatchery (LNFH). We have reviewed the draft permit and Fact Sheet, along with the expired permit and other documents. We have also reviewed various reports produced by the Washington Department of Ecology (Ecology) on the water quality and biological health of Icicle Creek, as well as the 2010 Clean Water Act Section 401 Certification issued by Ecology. Any cited documents that are not generally available are included with these comments, per 40 CFR 124.13. Our specific comments are organized by relevant sections of the Fact Sheet and draft permit. This letter also includes a request by WFC and CELP for a Public Hearing to address issues related to the compliance schedule proposed in the draft permit.

Identification of Groups Providing Comments and Requesting Public Hearing:

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Fact Sheet comments:

III. A. Point Source Demonstration. The Fact Sheet adequately demonstrates that the LNFH discharges pollutants into waters of the US through point sources. Such discharges are illegal without a Clean Water Act Section 402 permit. EPA does not need to consider the concentrated aquatic animal production facility regulation (40 CFR 122.24 and Appendix C of 40 CFR Part 122) when determining if this facility requires an NPDES permit.

III. C. Previous Permit and Permit History. We have long asserted, and a US District Court decision has recently affirmed, that the LNFH is discharging pollutants from point sources into waters of the United States without a permit in violation of the Clean Water Act. EPA issued draft NPDES permits in 2006 and 2010, but neither of those permits was finalized. According to EPA, the 2006 permit was not finalized because of two TMDL determinations made by Ecology before Ecology issued a 401 Water Quality Certification in 2010. EPA then decided to issue a new draft (the 2010 draft). This Fact Sheet states (p. 17) that EPA determined in 2011, after the comment period for the 2010 draft permit had closed, that operational changes made at the LNFH would necessitate the LNFH to submit a new application for a NPDES permit. That was received in 2011 and the LNFH submitted additional information in 2012.

EPA has not issued a final permit for this facility for the last thirty-seven years or enforced against it for unauthorized discharges, thus extending extraordinary latitude to this facility. If the permit is finalized as drafted, the facility will continue to pollute Icicle Creek and the Wenatchee River. EPA needs to close the loopholes in this permit.

V. A. Antidegradation. We disagree with EPA's decision to forgo an antidegradation analysis and rely on the Section 401 Certification from Ecology. EPA should have either 1) conducted its own antidegradation analysis and submitted that along with the rest of the draft permit to Ecology for the Section 401 Certification, or 2) waited to issue this draft notice until after receiving and incorporating the antidegradation analysis in the "preliminary" Section 401 Certification from Ecology. It is impossible for us or any member of the public to give this draft permit an adequate review when essential pieces are missing. EPA must allow another opportunity for public comment on this draft NPDES permit once an antidegradation analysis is available and included.

V. B. Receiving Water Low Flow Conditions. We have two concerns with this issue: 1) EPA used an inadequate dataset for its calculations and, 2) EPA failed to account for water diversions of Icicle Creek flow that could significantly affect low flow conditions adjacent to the LNFH.

1. The Fact Sheet states (p. 23) that

> The EPA reviewed information on Icicle Creek flows from the USGS gaging Station 12458000 (Icicle Creek Above Snow Creek, Near Leavenworth), which is located upstream of the LNFH. That selected stream flow field measurement data can be found at http://nwis.waterdata.usgs.gov/wa/nwis/measurements/?site_no=12458000&agency_cd=USGS
>
> The EPA accessed this website on May 18, 2016 and derived critical low flows for Icicle Creek upstream of the Hatchery using the stream flow data downloaded from the USGS website. The USGS labels the data that is posted online as "Good", "Fair", "Poor" or

> "Unspecified". The EPA took the subset of the flow data labeled "Good" and used it to calculate the critical low flows on Icicle Creek upstream of the LNFH. Critical flows can be calculated according to the EPA TSD, and are shown in the table, below.

We accessed the above link on January 19, 2017 and downloaded the dataset. Our examination indicates that the dataset includes only 168 field measurements of flow labeled "Good" on which presumably EPA has based its critical flow computations. We understand the concepts behind the various low-frequency flows and their applications, and have examined the referenced Technical Support Document for Water Quality-Based Toxics Control (TSD) (USEPA 1991). The TSD gives no information of the dataset's required size for a reliable computation of the various flows, but that's not surprising because as far as we can tell it is not meant to be a hydrology reference.

However, the US Geological Survey does give advice regarding low-frequency flows. A 2009 USGS document USGS 2009a) summarized the approach thus:

> Flow-duration data commonly are used to statistically characterize streamflow. Flow-duration data are daily mean flow values measured over a specified time interval that have been exceeded various percentages of the specified time interval. For example, a 5-percent exceedance probability represents a high flow that has been exceeded only 5-percent of all days of the flow record. Conversely, a 95-percent exceedance probability would characterize low-flow conditions in a stream, because 95 percent of all daily mean flows in the record are greater than that amount. For flow-duration statistics to be reliable indicators of probable future conditions, a minimum of 10 years of record typically is used (Searcy, 1959).

The referenced Searcy (1959) document is another USGS publication. Another recent USGS document (USGS 2009b) affirms the need for more extensive datasets:

> However, low-flow frequency statistics computed from continuous-record gaging stations with longer periods of record are likely to be more accurate than statistics from stations with shorter periods of record, and continuous record stations of any length are likely to be more accurate than statistics estimated at miscellaneous measurement sites.

In this case, it is unclear to us why EPA would choose a dataset with fewer than 200 miscellaneous measurements when the automated gage at the USGS station provides daily gage data and has since October 1, 1993[1]. Even if a number of recent readings have not yet been "approved" by USGS (those since June 5, 2016, when the dataset was accessed on January 23, 2017; measurements from June 6, 2016 to the present are labeled "provisional"), we calculate that the USGS dataset contains over 8000 daily flow records. This dataset should be used instead of the extremely limited dataset employed by EPA in preparing this draft permit, in keeping with accepted hydrological practice.

2. EPA's analysis of flow "augmentation" is sketchy and incomplete. The Fact Sheet states (p. 23) that:

> The EPA also reviewed Icicle Creek flow information downstream of the Hatchery at the

[1] The gage at that station also operated from 1936 through 1971, but we believe the more recent period (1993-present) would be more representative of current conditions considering climate change.

> Ecology Gaging Station 45B070. Those stream flow measurements can be found at https://fortress.wa.gov/ecy/eap/flows/station.asp?sta=45B070#block2
> The data is from flow measurements taken from 2007 -2015 at Ecology's monitoring station in 15 minute increments. The EPA accessed this website on May 18, 2016. The table below shows the calculated critical flow rates for Icicle Creek downstream of the Hatchery, using the low-flow calculations based on the EPA TSD.

We made a cursory examination of the dataset at the referenced Ecology website and it appears that there are many more data on which to calculate critical flows downstream of the LNFH (although we did not enumerate the number of daily flows rated as "good" by Ecology over the 10-year record), in contrast to the dataset EPA used described above. But we are unclear as to why EPA calculated critical flow rates below the LNFH. The Fact Sheet continues, after two tables comparing critical flows above and below the Hatchery:

> The data analyzed shows that the 1Q10, 7Q10, and 30Q5flows in Icicle Creek **are higher downstream of the LNFH than upstream**. The facility helps to augment Icicle Creek flows with its discharge, as previously noted, groundwater and supplemental water from Snow and Nada Lakes is pulled in to the Hatchery as influent, along with the water diverted from Icicle Creek and run through the facility (original emphasis).

If the reason for the emphasized first statement is to buttress the assertion in the second statement, we strongly disagree. "Augmentation" is very likely much less significant than thought by EPA. If the LNFH augments the flow of Icicle Creek at all, it is only during certain times of year. Some low-flow periods occur in autumn and winter when there are no significant diversions from Icicle Creek and no releases from Snow and Nada lakes.

First, "groundwater" from the LNFH's wells are for the most part, Icicle Creek water. The reason the LNFH established the new Outfall 006, as noted in the Fact Sheet (p. 16) is "to keep flow in the Hatchery Channel and recharge the LNFH groundwater wells." Almost all, if not all, groundwater used by the LNFH is essentially "recycled" Icicle Creek water (Montgomery Water Group 2004; Aspect Consulting 2016) as most of the LNFH's wells are in the shallow aquifer (hence, the need for aquifer recharge via Outfall 006). Groundwater yield from all of the LNFH's current wells is a maximum of 6-8 cfs (Aspect Consulting 2016) and recycled Icicle Creek water would make up the majority of that. The recharge area is located approximately at RM 3.8.

Second, Snow Lake and Nada Lake are high-elevation lakes in the Icicle Creek basin and it is not known how Icicle Creek flow would be affected if the lakes were left to their own devices and not manipulated by the LNFH. Without a detailed analysis, there is little basis for the statement that Icicle Creek flow is augmented by diversions from Snow and Nada lakes. Regardless, the net benefit downstream of the LNFH diversion at RM 4.5 would be at most 10-15 cfs (Snow/Nada augmentation minus LNFH/COIC diversion) (Montgomery Water Group 2004).

Most seriously, even if there was a net augmentation, EPA failed to adjust its calculated low-frequency flows at the USGG gage from diversions downstream of the gage but upstream of the LNFH's outfalls. The Icicle/Peshastin Irrigation District (IPID) diverts water downstream of the gage, as does the City of Leavenworth, the LNFH, and Cascade Orchard Irrigation Company (COIC). The COIC and LNFH share a diversion structure. These diversions are upstream of the LNFH's outfalls. The IPID diverts

80 to 100 cfs, and until they stop diversions in late September/early October, Icicle Creek flows can get much lower than even the 1Q10 calculated by EPA. Montgomery Water Group (2004) estimated that in 1998, an **average** flow year, September flows downstream of the LNFH/COIC diversion (but upstream of the LNFH discharges) were only 26.0 cfs.

In other words, it should not be surprising to see higher flows downstream of the LNFH because major water diversions downstream (e.g., IPID and COIC) of the USGS gage usually cease diversions in September. The only "consumptive" use of Icicle Creek in that reach is the City of Leavenworth that withdraws a relatively insignificant (2 cfs) amount. The LNFH withdraws water at RM 4.5 and at times in the past diverted water for aquifer recharge at RM 3.8 (which gets withdrawn as groundwater) but discharges that water back at RM 2.8. Ecology's gage is at RM 2.2.

Attached as an Appendix to these comments is a report prepared by Wild Fish Conservancy and the Icicle Creek Watershed Council and submitted by those groups along with CELP and Ms. Harriet Bullitt to the full Icicle Working Group in 2013 (WFC and CELP are no longer members of the IWG). It illustrates the complex hydrology of Icicle Creek with its numerous diversions, some seasonal, and various additions of water, all based on low-frequency flow statistics calculated using an adequate database. The report should not be relied upon as accurate as to what "projects" the IWG may now be considering to augment instream flow or reduce diversions; if EPA desires that information it should contact the IWG directly. Instead, we include it so that EPA can better understand the flow characteristics of Icicle Creek in the vicinity of the LNFH and to point out that critical low flows can occur in October and December when major diversions and additions from Snow and Nada lakes have ceased for the season[2].

Our overall point regarding is that besides using a limited data set to calculate low-frequency design flows, EPA failed to take into account the seasonal nature of major diversions that occur on Icicle Creek. EPA may have grossly overestimated the "augmentation" of Icicle Creek flow by the LNFH. Critical low flows should be computed on a monthly basis using more relevant and up-to-date information regarding the diversions, and a larger streamflow dataset.

V. B. Technology-Based Effluent Limits

The discussion on p. 32 of how the kg/day limit is derived refers to the wrong units for the 3.79 multiplier. In order to go from mg/L and MGD to kg/day, the correct multiplier would have units of liters/gallon (which is, in fact, 3.79). This is very confusing to the reader (the Permit itself does not specify the units on the conversion factor; see p 12 n. 34). This needs to be made correct and consistent.

C. Water Quality Limited Waters. In the subsection entitled *Dissolved Oxygen, pH, and Total Phosphorus* (p. 25), EPA correctly notes that the EPA-approved TMDL for dissolved oxygen, pH, and total phosphorus envisioned attainment of water quality standards by 2019.

[2] One of the diversions from Icicle Creek that the report listed was 20 cfs diverted at Structure 2 for groundwater recharge. Now, the LNFH's operation of its new Outfall 006 would obviate the need for diverting Icicle Creek water. Even if that 20 cfs is not subtracted, the report shows flows much lower than EPA's calculated critical flows, especially in the reach between the LNFH diversion (RM 4.5) and Outfall 001 at RM 2.8.

In the subsection entitled *Polychlorinated biphenyls (PCBs)* EPA cites the 2005 USFWS study on PCBs. As we pointed out in our comments on the 2006 draft permit and the 2010 draft permit, that study has serious limitations. We are disappointed that EPA continues to rely on it. The Ecology study (Ecology 2016), despite its limitations in the number of samples, is more credible than the USFWS (2005) study as a reason for including only BMPs to manage PCBs through this permit.

VI. C. Water Quality-Based Effluent Limits.

We believe EPA should re-analyze the WQBEL calculations using critical design flows derived from a more complete data set (refer to our comments on **V. B. Receiving Water Low Flow Conditions**, above).

D. Facility Specific Limits.

The opening paragraph of this section should include a statement regarding that both TBELs and WQBELs are subject to an anti-backsliding review, as it seems as if the final effluent limitations for total suspended solids were based on neither a TBEL nor a WQBEL basis.

The subsection entitled *Temperature* discusses USFWS data regarding instream temperatures and the effects of flow additions from Snow and Nada lakes via Snow Creek. We do not dispute the data and therefore the temperature reduction that occurs as a result of the addition, but feel the need to point out that the increase in instream temperature downstream of the LNFH/COIC diversion structure is aggravated by the LNFH's large diversion of water from Icicle Creek, subjecting the remaining flow to increased warming. The discussion and graph on p. 44 seems to belong better in this section than in the discussion on the compliance schedule. EPA does not give any reason why it chose the 95th percentile of the 7DADMs as the interim limit for temperature.

Regarding the subsection entitled *Total Phosphorus*, we believe that the discussion on pp 45-46 regarding the dataset for total phosphorus should be in this section.

EPA uses the 95th percentile of the monitoring data from Outfalls 001 and 002 to set interim limits, and goes on to convert the "average monthly limit" to a "maximum daily limit" for each Outfall. The Fact Sheet references the TSD and we are unclear as to why EPA used this document (that supports WQBEL development for toxic substances) as a reference to derive what is essentially a technology-based, or performance-based limit.

But we are more concerned about the use of the 95th percentile for both temperature and total phosphorus. EPA does not state why it uses the 95th percentile rather than the 50th, 75th, 90th or the 99th, for instance).

The graphs on page 46 are not based on continuous data and the data should be depicted as should be scatter graphs rather than line graphs that imply continuous data. Also, EPA should have, if it did not, discounted the data points gathered outside the period of time when the WLA would be in effect (March 1 – May 31 and July 1 – October 31) to account for relevant seasonal differences in influent/effluent quality.

We also question why the phosphorus dataset is so limited. We understand that EPA considered the data submitted by the LNFH in 2011, but Ecology ordered the LNFH to conduct total phosphorus monitoring in the Section 401 Certification issued in 2010. Seeing as how EPA didn't release a draft permit until late in 2016, there should have been a more extensive dataset.

We note that **the sum of the mass-based interim maximum daily limits from Outfalls 001 and 002 is nearly seven times (1.6 kg/day + 1.9 kg/day) the mass-based final maximum daily limit for the facility (0.52 kg/day).** We believe that this is too high and EPA should use a lower percentile (e.g., 50th or 75$^{th)}$ in order to further limit the pollution of Icicle Creek and the Wenatchee River in the long interval until the final effluent limitations are in effect.

EPA makes a reasonable assumption that the monitoring data from 2006-2011 is a reflection of the operational changes the LNFH has made since 2005 as outlined on page 17 of the Fact Sheet:

> These changes included, but are not limited to, actions to improve the quality (i.e., lower phosphorus levels) of the water discharged by the LNFH into Icicle Creek. The changes to LNFH operations that have occurred since 2005 included, but are not limited to: (1) a reduction in hatchery production from 1,625,000 to 1,200,000 million (*sic*) SCS; (2) the use of low phosphorus feed during the critical months of March, April, July, August, and September (with the exception of feed for fry in the nursery) when available; and the construction and operation of a second pollution abatement pond.

We note that the *US v. Oregon* Management Agreement (https://www.fws.gov/pacific/fisheries/hatcheryreview/Reports/snakeriver/SR--079.revised.2008-17USvOR_Mngmt_Agrmt.pdf) expires at the end of this year, and the current Agreement states that the reduction in the LNFH's production is considered to be an "interim action" and that the parties intend to bring the production levels back to the 1.625 million SCS production level. This was also affirmed at a recent Icicle Working Group meeting (IWG 2017). *US v. Oregon* cannot mandate higher production at the cost of water quality standards violations. Until the LNFH makes major changes to its infrastructure to reduce phosphorus loading, more fish produced at this facility means more pollution.

EPA has set abnormally high interim limits for total phosphorus and nearly ten years to comply with the final limit, perhaps giving room for the LNFH to expand production and therefore not only continue, but perhaps worsen the on-going pollution of Icicle Creek and the Wenatchee River. EPA should set lower interim limits for total phosphorus and place enforceable permit conditions mandating the use of lower phosphorus fish food during the critical times of year.

E. Schedules of Compliance for Temperature and Total Phosphorus (also comments on Table 4 of the draft permit).

The reference to Idaho's WQS in the opening paragraph appears to be a typo. Please see our comments above regarding the discussion on pp. 45-46 of this section regarding the phosphorus dataset and EPA's derivation of the interim limit.

We have examined the USEPA NPDES Permit Writers' Manual (USEPA 2010) and the memorandum referenced in the Compliance Section of the Manual (USEPA 2007). We note the following points taken from the memorandum (USEPA 2007).

> 5. In order to grant a compliance schedule in an NPDES permit, the permitting authority has to make a reasonable finding, adequately supported by the administrative record, that the compliance schedule "will lead[ ] to compliance with an effluent limitation . . . " "to meet water quality standards" by the end of the compliance schedule as required by sections 301(b)(1)(C) and 502(17) of the CWA. See also 40 C.F.R. §§ 122.2, 122.44(d)(1)(vii)(A).
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> 8. Factors relevant to whether a compliance schedule in a specific permit is "appropriate" under 40 C.F.R. § 122.47(a) include: how much time the discharger has already had to meet the WQBEL(s) under prior permits; the extent to which the discharger has made good faith efforts to comply with the WQBELs and other requirements in its prior permit(s); whether there is any need for modifications to treatment facilities, operations or measures to meet the WQBELs and if so, how long would it take to implement the modifications to treatment, operations or other measures; or whether the discharger would be expected to use the same treatment facilities, operations or other measures to meet the WQBEL as it would have used to meet the WQBEL in its prior permit.
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> 9. Factors relevant to a conclusion that a particular compliance schedule requires compliance with the WQBEL "as soon as possible," as required by 40 C.F.R. § 122.47(a)(1) include: consideration of the steps needed to modify or install treatment facilities, operations or other measures and the time those steps would take. The permitting authority should not simply presume that a compliance schedule be based on the maximum time period allowed by a State's authorizing provision.

We disagree with the decision to give the LNFH a 9 year, 11 month compliance schedule. Paragraph 5 cited above states that EPA must have evidence that the final limit will in fact be met by the end of the compliance schedule. Because nothing is cited in this section of the Fact Sheet, we must assume that EPA does not have any evidence that the LNFH can in fact meet the final limit by the end of the compliance schedule.

Regarding Paragraph 8 cited above, the LNFH has known about water quality issues from temperature and, especially, phosphorus for some time. Ecology first identified high phosphorus loading from Icicle Creek that was attributable to the LNFH in Ecology's field study to support TMDL development (Ecology 2006). USFWS acknowledged this in Biological Assessments for hatchery operations prepared in 2006 and 2011 (USFWS 2006; 2011). In 2010, Ecology issued a Section 401 Water Quality Certification that directed compliance with the WLA for total phosphorus within five years, based on the TMDL's target for attaining WQS in the basin by 2018 (Ecology 2010). The Certification also directed the LNFH to conduct phosphorus and temperature monitoring, and develop plans to reduce phosphorus loading and temperatures. The LNFH did not prepare the required plan to monitor phosphorus.

The LNFH has moved at a very slow pace to address these problems. The LNFH investigated a recirculating system in 2009 (Freshwater Institute, 2009) but even now it has not yet reached a pilot stage (IWG 2017). It seems to be content to continue business as usual, and the extremely high interim limits combined with a very generous compliance schedule allows pollution to continue.

Paragraph 9 cited above indicates that compliance schedules should not simply be extended to the maximum allowed by a states WQS. Washington allows a maximum of 10 years. This compliance schedule is 9 years, 11 months, and it appears to us that reducing the maximum by only one month is token attempt to comply with this guidance. EPA is essentially extending to the LNFH the maximum time possible. If EPA has specific information regarding the LNFH's timetable that speaks to the specific need for a 9 year, 11 month compliance schedule, it should discuss it in the Fact Sheet.

Table 4 outlines the schedules of compliance for temperature and total phosphorus. We believe that for the most part, the tasks repeat what the LNFH was already ordered to do in Ecology's 2010 Section 401 Certification, or else they refer to events in the future that no one, including EPA, can reasonably predict. Regarding the first point, the LNFH is directed in Task 2 to:

> At a minimum, the feasibility of the following measures must be evaluated for achieving compliance with the effluent temperature limits:
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> 1) facility improvements and/or adding additional technologies to facility operations;
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> 2) offsets and/or possible trading mechanisms; such as offsite mitigation;
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> 3) shading and riparian restoration; and
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> 4) changes in/to sources of Hatchery influent, in addition to any other measures evaluated by the Permittee.

The LNFH was directed to do the following by Ecology in the 2010 Section 401 Certification:

> Instream Temperature. Within two years of the issuance of this Order, the Leavenworth NFH shall submit a Temperature Study Plan to evaluate measures to reduce temperatures in Icicle Creek. The Temperature Study Plan shall include a QAPP consistent with the requirements of paragraph D for monitoring water temperatures at appropriate locations and frequencies and shall be submitted to Ecology for its review and written approval.
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> i. Plan Contents. The Temperature Study Plan shall include an evaluation of measures to:
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> - Lower temperatures in Icicle Creek to temperatures that would occur under natural conditions, focusing on the critical period between June and October.
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> - Meet the site-potential shade throughout the length of the historic river channel and hatchery channel.
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> ii. Plan Review and Approval. Within four years of the issuance of this Order, the Leavenworth NFH shall submit a report describing the results of the above study, including the

environmental impacts, feasibility, costs, and potential schedules for implementation of each feasible alternative. Once approved by Ecology, the Leavenworth NFH shall within 180 day prepare and submit an Implementation Plan for review and written approval by Ecology.

iii. Implementation. Upon Ecology's approval of the Implementation Plan, Leavenworth NFH shall implement it in accordance with the schedule set forth in the approved Implementation plan.

In a January 6, 2016 letter to Ecology, the LNFH requested that the 2010 Section 401 Certification be rescinded, in part because "the FWS has completed all of the scientific analysis" [and] "is continuing to pursue ongoing studies… as requested by DOE in the 2010 CWA 401 certification." If in fact the LNFH has done much or all of what Ecology requested in 2010 regarding temperature, it would seem that EPA's Task No 2. listed in Table 4 of the permit is redundant. The LNFH should be at or near the implementation phase in order to meet the temperature limits in this draft permit.

Similarly, the specific directives regarding phosphorus are similar or identical to the tasks outlined in EPA's draft 2010 permit or Ecology's 2010 Section 401 certification. The LNFH has long known what it needs to do to reduce its phosphorus loads.

Task No. 4 of Table 4 regarding design is envisioned to take place five years from permit issuance, while its analog in the 2010 draft permit was envisioned to need only three years. Seeing as how the LNFH has known about its excess phosphorus loading since 2006, known of the enforceable TMDL and its WLA since 2009, and was under an Ecology order in 2010 to comply with the WLA by 2015, we believe that another five years to reach a suitable design is too generous. As we said above, the LNFH had received plans for a pilot recirculation system in 2009 that it still has not implemented. This history of this hatchery is clear: it uses time not to take action, but to find other reasons why it should be given yet more time.

Overall, we do not believe that the LNFH has made a good-faith effort to address the temperature and phosphorus issues that it has known about for over a decade. It should not be given another decade to begin to comply with the WQS; neither has EPA shown sufficient reason why this facility should be given such a long compliance schedule.

VIII. B. Best Management Practices (BMP) Plan. We believe that there should be a permit condition mandating cleaning of the pollution abatement ponds, either on a temporal or performance-based (e.g., when sediments reach a certain depth) basis. EPA should consider Conservation Recommendation 17 of the Biological Opinion on the Operation and Maintenance of the Leavenworth National Fish Hatchery through 2011 (FWS Service Reference Numbers 13260-2008-F-0040 and 13260-2006-P-00102008; February 15, 2008) which states: "After the pond is cleaned of its current material, ensure that in the future the pollution abatement pond is cleaned frequently enough that it adequately protects water quality, regardless of whether it is physically full or not. This effort should not contradict any instructions or requirements that may be included by EPA in the NDPES permit. Guidance how to calculate efficiency of a pollution abatement pond, when to clean it, and other considerations can be found at:" https://www.deq.idaho.gov/media/488801-aquaculture_guidelines.pdf (link updated from that listed in the Biological Opinion). Language such as this should be placed into the LNFH permit.

IX. A. Endangered Species Act. We note that the LNFH-specific Foreword that EPA prepared and submitted to the Services along with the Federal and Tribal Hatchery General NPDES Permit does not mention the 9 year, 11 month, compliance schedule. We do not believe that issuance of this permit, that does not require compliance with water quality standards until nearly 10 years from permit issuance, translates to a "may affect, not likely to adversely affect" the ESA-listed salmonids of Icicle Creek and the Wenatchee River. Given that the water quality criteria that are violated by the facility (dissolved oxygen, pH, and temperature) are in place to protect aquatic life, we believe that the issuance of this permit will result in "take" of listed species. Such "take" is a violation of Section 9 of the ESA absent an incidental take statement issued by the appropriate Service (NOAA Fisheries or USFWS). We believe that EPA should request formal consultation from the Services to fully comply with its ESA duties.

Draft Permit comments:

Regarding the 15.0 mg/L instantaneous maximum limit for net Total Suspended Solids in Table 1, we believe that analyzing a grab sample would provide a more meaningful result than from analyzing a composite sample.

Summary: While this permit is an improvement over the 2010 draft, it still has major flaws that will allow pollution of Icicle Creek and the Wenatchee River to continue. Most notably:

- EPA used an insufficient dataset to calculate critical design flows and does not show that it has an adequate understanding of the impact of water diversions on Icicle Creek low flows;
- there is no antidegradation analysis included with the draft permit, nor has a preliminary Section 401 Certification that includes such an analysis been done and included with the draft permit;
- the interim limits for temperature and phosphorus allow for unacceptably high loads, i.e., pollution to the receiving waters;
- the 9 year, 11 month compliance schedule is not warranted given the decade that the LNFH has had to address these problems but has not; and
- the interim limits and long compliance schedule will result in continued "take" of ESA-listed salmonids and EPA should formally consult with the Services to ensure their action will not jeopardize listed species.

We recommend that EPA withdraw this permit, address the above major concerns, and re-issue another draft as soon as possible.

Request for Public Hearing:

WFC and CELP hereby request that EPA hold a public hearing on the draft NPDES permit. The issues to be addressed at the hearing relate to the compliance schedule proposed in the draft permit for phosphorus, including whether the facility will meet the limit at the end of the compliance schedule and whether the compliance schedule requires compliance with the WQBEL "as soon as possible."

Thank you for the opportunity to comment.

Sincerely,

Kurt Beardslee
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Trish Rolfe
Center for Environmental Law and Policy

References:

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Appendix: Report of CELP, Harriet Bullitt, ICWC, and WFC to the Icicle Working Group Facilitation Team on Low Flows. July 2013.

Analysis of Icicle Creek Instream Flow Benefits Of Three "Base Projects" During Low-Flow Months

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and

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July 2013

Executive Summary

The Center for Environmental Law and Policy, Harriet Bullitt, Icicle Creek Watershed Council, and Wild Fish Conservancy are stakeholders in the Chelan County-led effort to improve instream flows in Icicle Creek. A number of "base projects" were proposed at the May 17, 2013, meeting in Leavenworth. The projects either increase flow by releases from storage in the basin, or preclude the need to divert Icicle Creek water through improvements/efficiencies to irrigation system or by diverting water from the Wenatchee River.

At the May 17, 2013 meeting of the Icicle Working Group, Chelan County proposed an initial "Integrated Project List" that included nine base projects. Three of those nine base projects are analyzed in this paper: 1) a "pump exchange" with the Icicle-Peshastin Irrigation Districts(IPID), 2) improvement efficiencies in the IPID and Cascade Orchards Irrigation Company (COIC) systems, and 3) savings in water diverted by the Leavenworth National Fish Hatchery (collectively the "three base projects"). While the group expressed general support for the overall goal of these three projects—increasing flows in Icicle Creek—there was not consensus that these three projects would be the most effective means of achieving that goal. Moreover, a number of stakeholders expressed concern about two other base projects involving some of the Alpine Lakes, as well as the project to amend the Icicle instream flow rule.

This report assesses the benefits of the three base projects against low stream flows in September, October, and December. The three base projects will not result in enough "saved" water (not diverted from Icicle Creek) to result in sufficient instream flow. Definite predictions on habitat cannot be made until the results of the IFIM study for the historical channel (RM 3.8 to 2.8) are available, but this examination of low-flow months indicates that even after the three base projects are implemented, periods of very low instream flows would occur.

One reason why this is the case is that two of the three base projects affect only seasonal diverters – the IPID and COIC. Even though up to 40 cfs may no longer need to be diverted from Icicle Creek after implementing a pump exchange program with IPID and realizing improvements and efficiencies to both irrigation systems, those savings will not apply once those entities stop diverting on September 30 of the year. Any improvements after that date must come from either smaller diversions by the Leavenworth National Fish Hatchery, or from instream flow augmentation from storage, which may be problematic in autumn and winter.

The following chart summarizes the analysis. For many days in September, December, and especially October, Icicle Creek would continue to experience insufficient benchmark flows between RM 4.5 to RM 2.8, even after the three base projects were implemented.

Month / Flow	**Days below 50 cfs**	**Days below 40 cfs**	**Days below 30 cfs**
September	18	10	0
October	31	28	9
December	8	3	1

These data indicate that as much or more attention must be paid to instream flow in October and December as in September.

Introduction

The purpose of this report is to assess the benefits of three "base projects" presented at the May 17, 2013 meeting of the Icicle Subbasin stakeholders. Those projects include: 1) a "pump exchange" with the Icicle-Peshastin Irrigation Districts (IPID) that results in 30 cfs not diverted from Icicle Creek, 2) improvement efficiencies in the IPID and Cascade Orchards Irrigation Company (COIC) systems resulting in another 10 cfs not diverted, and 3) savings in water diverted by the Leavenworth National Fish Hatchery resulting in a savings of 20 cfs. A number of stakeholders, however, expressed concern about other base projects, 1) Alpine Lakes optimization, modernization, and automation (14.57 cfs over 75 days); 2) Eight-Mile Lake restoration, involving some of the Alpine Lakes; and 3) amending the instream flow rule. Those projects will not be assessed, although this report can serve as a basic template to evaluate the benefits of implementing other projects.

The presentation on May 17 used the mean flow of the month of September for Icicle Creek as a basis for comparison, i.e., how the implementation of the base projects will improve habitat over that provided by the mean (average) monthly flow for September. It is not clear why the mean flow was used. Mean flows are skewed by high runoff events and can therefore give a false sense of security. A flow that reflects a frequency -- *how often* a flow occurs -- is more to the point than the average monthly flow for comparison purposes. For instance, if one chose the median flow, one would then be sure that the chosen baseline flow occurred at least 50% of the days of the time period in question. Another way to express the median flow is the "50% exceedence flow."

Assembling a set of projects for the purpose of augmenting stream flow to protect aquatic life and aesthetics, however, should use a more stringent flow than the median flow. The 95% exceedence flow, those flows that are equaled or exceeded 95% of the time, is a reasonable flow to use for this purpose. First, if the effort to improve aquatic life is to succeed, it needs to ensure that adequate flow will be realized almost every year. Adequate flow for one-half or even three-quarters of the years will not suffice. Second, recovery of steelhead and bull trout will be greatly enhanced by more normative flows. Besides habitat, adequate flow is needed so that these fish can negotiate fish passage impediments. These impediments can become blockages if flow is inadequate.

Low flows in Icicle Creek occur in late summer and early fall. September is therefore a proper month to consider. But low flows can also occur later in autumn or in winter. While the seasonal aspect of the IPID diversion assures that the largest diverter is no longer a factor by September 30, the same cannot be said about the second-largest diverter, the LNFH, which diverts surface water year-round. For that reason, this exercise constructed low-flow hydrographs for the months of September, October, and December[1], and compared the existing conditions to those that would result if the three base projects described above were implemented. This was done in order to ensure that the stakeholder effort does not go to great lengths to augment stream flow for aquatic life in September -- only to find the habitat is quickly lost in October or December.

1 A cursory examination indicated flows in December were generally lower than those occurring in November, January, February, or March.

This exercise does not attempt to look ahead to the changes that are happening to climate and Icicle Creek hydrology, not because they are not important, but due to a lack of time. This exercise did construct the low-flow monthly hydrographs using the flow data from water years 1994 through 2012, rather than use the entire period of record. That is contrary to what hydrology texts recommend, that is, using as long as a record as possible. Because evidence of a changing climate is already apparent from an examination of the record, however, we concluded that the years since 1994 would be more predictive of future conditions. In any event, we believe that the working group must assess any package of projects through the expected changes to the yield of the Icicle Creek watershed over the next thirty to fifty years.

Methods

Flow Record

As stated above, this report uses the USGS Icicle Creek gage station (12458000) at RM 5.8, from the years 1994-2012. The 2004 Water Management Plan states that the flow record is augmented in summer months by a 15 cfs release from the Alpine Lakes by IPID. The 95% exceedence flows were derived from the daily flow record for the months of September, October, and December using Excel. Those flows were then put into tabular form along with the diversion and additions of Icicle Creek in descending order (RM 5.8 to RM 2.8).

Base Projects

The evaluated projects include three projects ("base projects") presented by Chelan County at the May 17, 2013, stakeholder meeting in Leavenworth (Table 1).

Table 1. Base projects evaluated in this report.

Project Name	**Description**	**Instream flow benefit**
Icicle-Peshastin Irrigation District (IPID) Pump Exchange	Pump exchange at Dryden or Leavenworth	30 cfs (May 1 to Sep 30); for this exercise, September only
IPID and Cascade Orchard Irrigation Company Efficiencies	Management plan and infrastructure improvements	9.9 cfs (5 cfs from IID, 3.3 cfs from PID, 1.6 cfs from COIC; May 1 to Sep 30); for this exercise, September only
Leavenworth National Fish Hatchery conservation	Combination of on-site reuse, effluent pump-back (for aquifer recharge), or wellfield enhancements	20 cfs (presumably year-round; this exercise assumes that the project was something that obviated the need for the aquifer recharge diversion)

The "base project" for the LNFH was a "performance standard" of 20 cfs water saved, and in this analysis it is assumed to have been attained through a cessation of the diversion for aquifer recharge (RM 3.8). If the LNFH "performance standard" was met, for instance, through a 20 cfs reduction in the surface water diversion at RM 4.5, any instream flow benefits would accrue in a longer reach (RM 4.5 to RM 2.8 *vs*. RM 3.8 to 2.8).

Diversions and Additions

The 2009 LNFH Proposed Flow Management Operations document and the 2004 LNFH Water Management Plan (by the Montgomery Water Group) give estimates for various amounts of water diverted or added to Icicle Creek by the various water right holders (Table 2). The amounts assigned to diverters in Table 2, are less than the recorded water rights, with the exception of the City of Leavenworth, as the amount assigned is equal to the recorded water right.

Table 2. Diversions and additions to Icicle Creek in descending river mile (RM) order.

	RM	**Type**	**Duration**	**Amount used in this analysis (cfs)**
City of Leavenworth intake	5.7	diversion	Year-round	2 (all months)
Icicle-Peshastin Irrigation District intake	5.7	diversion	May 1 to Sep 30	78 (Sep only)
Snow Creek confluence	5.5	addition	Base flow of stream is year round; LNFH adds water from Snow/Nada lakes in August and September	50 (Sep, the contribution from Snow Creek plus Snow/Nada lakes); 4 (Oct and Dec, representing base flow in Snow Creek)
Leavenworth National Fish Hatchery surface water intake	4.5	diversion	Year-round	40, 41, and 35 for Sep, Oct, and Dec, respectively
Cascade Orchard Irrigation Company intake	4.5	diversion	May 1 to Sep 30	6 (September only)
Leavenworth National Fish Hatchery headgate (used to divert water for aquifer recharge)	3.8	diversion	As needed in the period August through March when stream flows are less than 300 cfs*	Assumed to be 20 cfs, or stream flow when stream flow less than 20 cfs **
Leavenworth National Fish Hatchery fish ladder/outfall plus any flow over spillway dam	2.8	addition	Year-round	Sum of surface water intake + ground water used (Sep: 40 + 7; Oct 41+ 4; Dec 35 + 5)***

*The 2011Biological Assessment (prepared for the ESA consultation for bull trout) states " [w]hen stream flow in Icicle Creek is approximately below 300 cfs, LNFH may need to lower one or more radial gates of structure 2 for fifteen or more days at a time to ensure that enough water is in the hatchery channel for aquifer recharge." There are no ESA constraints on the LNFH's operation of Dam 2 for aquifer recharge in September, October, or December.

[**]A figure of 20 cfs was chosen to equal the 20 cfs "performance standard" assigned to the LNFH in the stakeholder process; an assumption that a diversion of only 20 cfs occurs when stream flow is greater than 20 cfs gives the benefit of the doubt to the LNFH. In any case, for this analysis, 20 cfs was considered sufficient to recharge the aquifer, although this calculation is not intended to be an accurate model of the groundwater use or recharge characteristics of this reach, but instead a simplification constructed for this analysis.

[***] Before the projects are implemented. This projection assumes that ground water use equals pump-back in a steady-state; therefore, after the three base projects were implemented, the addition at RM 2.8 consists solely of the surface water diversion amount.

Results

Existing Conditions: September

September low flows are critical in that diversions continue to take place as stream flow decreases to nearly base flow (Table 3). Flows at the USGS gage (RM 5.8) fall below 100 cfs. The 95% exceedence flow for many days in September is insufficient for the IPID and City of Leavenworth diversions.

Currently, the LNFH releases ~ 50 cfs from Snow and Nada lakes (plus the base flow from Snow Creek) that enters Icicle Creek at RM 5.5. That water supplies the LNFH's diversion plus enough to operate the fish ladder at the diversion dam at RM 4.5. Many days in a low-flow September, the reach from RM 4.5 to RM 3.8 is wetted only by a few cfs of water that is not diverted by LNFH and COIC. But any remaining water can be diverted (and during low-flow periods, is very likely to be diverted) by LNFH at the headgate at RM 3.8 into the hatchery canal to recharge the aquifer.

The existing conditions scenario indicates that the LNFH essentially releases the water it needs for its surface water diversion from Snow/Nada lakes, as Icicle Creek flow is not sufficient for all users. Below the IPID/City intakes, the stream flow is essentially zero. The Snow/Nada lakes addition wets the channel between RM 5.5 and 4.5, but downstream of the LNFH/COIC intakes, the stream is again reduced to near zero. Any remaining water is liable for diversion by LNFH for aquifer recharge at RM 3.8.

Table 3. Instream flow in Icicle Creek during existing conditions in a low-flow September (95% exceedence flow).

		Flow-affecting event (diversion or addition)				
	RM 5.8: Icicle Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 80 cfs (IPID 78 cfs net; City 2 cfs)	RM 5.5: Plus 50 cfs (Snow/Nada Lakes + Snow Creek base flow)	RM 4.5: Minus 46 cfs (LNFH 40 cfs ; COIC 6 cfs)	RM 3.8: Minus 20 cfs or stream flow if less than 20 (LNFH aquifer recharge diversion)	RM 2.8: Plus 47 cfs (LNFH surface water diversion plus ground water use)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 3.8	RM 3.8 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Sep	117	37	87	41	25	72
2-Sep	109	29	79	33	13	60
3-Sep	100	20	70	24	4	51
4-Sep	101	21	71	25	5	52
5-Sep	99	19	69	23	3	50
6-Sep	96	16	66	20	0	47
7-Sep	93	13	63	17	0	47
8-Sep	90	10	60	14	0	47
9-Sep	88	8	58	12	0	47
10-Sep	91	11	61	15	0	47
11-Sep	90	10	60	14	0	47
12-Sep	87	7	57	11	0	47
13-Sep	84	4	54	8	0	47
14-Sep	85	5	55	9	0	47
15-Sep	81	1	51	5	0	47
16-Sep	81	1	51	5	0	47
17-Sep	81	1	51	5	0	47
18-Sep	78	0	50	4	0	47
19-Sep	78	0	50	4	0	47
20-Sep	76	0	50	4	0	47
21-Sep	75	0	50	4	0	47
22-Sep	74	0	50	4	0	47
23-Sep	74	0	50	4	0	47
24-Sep	73	0	50	4	0	47
25-Sep	72	0	50	4	0	47
26-Sep	71	0	50	4	0	47
27-Sep	71	0	50	4	0	47
28-Sep	70	0	50	4	0	47
29-Sep	70	0	50	4	0	47
30-Sep	74	0	50	4	0	47

With Base Projects Implemented: September

With implementation of the three base projects (assuming that the IPID pump exchange is 30 cfs, not 15 cfs as originally proposed), stream flow generally improves. However in a low-flow year, the three base projects are insufficient. Assuming a 30 cfs input into Icicle Creek from the pump-exchange project plus an additional 10 cfs realized from improvement/efficiencies from IPID and COIC, the reach from RM 4.5 to 2.8 nonetheless falls below 50 cfs for almost 2/3 of the days in a low-flow September, and that is even when Snow/Nada lakes water is released (Table 4).

In addition to returning water to the Icicle Creek from the three base projects, assurances, via binding agreements, must be made to ensure that any newly returned water stays in the Creek. Specifically 1) IPID must agree to continue to augment Icicle Creek flow with at least 15 cfs from Alpine Lakes during low-flow years; and 2) LNFH must agree to continue to release Snow/Nada lakes water, and not capture the saved water from the IPID pump exchange/efficiency projects. Also, we suggest that if the IPID intake is rebuilt and properly screened as part of this package of projects, that the intake be sized to the water right minus the project savings.

Table 4. Instream flows during a low-flow September after three base projects implemented.

		Flow-affecting event (diversion or addition)			
	RM 5.8 Klock Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 42 cfs (IPID 40 cfs; City 2 cfs)	RM 5.5: Plus 50 cfs (Snow/Nicola Lakes + Snow Creek base flow)	RM 4.5: Minus 46 cfs (LNFH 40 cfs ; CCHC 4 cfs)	RM 2.8: Plus 40 cfs (LNFH surface water diversion plus ground water use)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Sep	117	75	125	81	121
2-Sep	109	67	117	73	113
3-Sep	100	58	108	64	104
4-Sep	101	59	109	65	105
5-Sep	99	57	107	63	103
6-Sep	96	54	104	60	100
7-Sep	93	51	101	57	97
8-Sep	90	48	98	54	94
9-Sep	88	46	96	52	92
10-Sep	91	49	99	55	95
11-Sep	90	48	98	54	94
12-Sep	87	45	95	51	91
13-Sep	84	42	92	48	88
14-Sep	85	43	93	49	89
15-Sep	81	39	89	45	85
16-Sep	81	39	89	45	85
17-Sep	81	39	89	45	85
18-Sep	78	36	86	42	82
19-Sep	78	36	86	42	82
20-Sep	76	34	84	40	80
21-Sep	75	33	83	39	79
22-Sep	74	32	82	38	78
23-Sep	74	32	82	38	78
24-Sep	73	31	81	37	77
25-Sep	72	30	80	36	76
26-Sep	71	29	79	35	75
27-Sep	71	29	79	35	75
28-Sep	70	28	78	34	74
29-Sep	70	28	78	34	74
30-Sep	74	32	82	38	78

Existing Conditions: October

By October 1, Icicle Creek is no longer augmented by releases from the Alpine Lakes by IPID (reflected in the gage record). In addition, LNFH has stopped its releases from Snow/Nada lakes and the contribution from the Snow Creek watershed consists only of base flow. According to its Proposed Flow Management Operations plan, LNFH continues its surface water diversion (41 cfs) and could divert water into the canal for aquifer recharge (again, assumed as a 20 cfs diversion). In a low-flow year, the LNFH would almost certainly divert water in October for aquifer recharge purposes.

These factors result in little water in in Icicle Creek in October (Table 5). Instream flow in the historical channel is less than 20 cfs during all but three days in October.

Table 5. Instream flow in Icicle Creek during existing conditions in a low-flow October (95% exceedence flow).

		Flow-affecting event (diversion or addition)				
	RM 5.8: Icicle Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 2 cfs (City)	RM 5.5: Plus 4 cfs (Snow Creek base flow)	RM 4.5 Minus 41 cfs (LNFH surface water diversion)	RM 3.8: Minus 20 cfs (LNFH aquifer recharge diversion)	RM 2.8: Plus 45 cfs (LNFH surface water diversion plus ground water use)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 3.8	RM 3.8 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Oct	70	68	72	31	11	56
2-Oct	68	66	70	29	9	54
3-Oct	67	65	69	28	8	53
4-Oct	66	64	68	27	7	52
5-Oct	65	63	67	26	6	51
6-Oct	65	63	67	26	6	51
7-Oct	65	63	67	26	6	51
8-Oct	65	63	67	26	6	51
9-Oct	69	67	71	30	10	55
10-Oct	68	66	70	29	9	54
11-Oct	67	65	69	28	8	53
12-Oct	69	67	71	30	10	55
13-Oct	75	73	77	36	16	61
14-Oct	76	74	78	37	17	62
15-Oct	77	75	79	38	18	63
16-Oct	74	72	76	35	15	60
17-Oct	73	71	75	34	14	59
18-Oct	71	69	73	32	12	57
19-Oct	70	68	72	31	11	56
20-Oct	70	68	72	31	11	56
21-Oct	74	72	76	35	15	60
22-Oct	73	71	75	34	14	59
23-Oct	77	75	79	38	18	63
24-Oct	79	77	81	40	20	65
25-Oct	86	84	88	47	27	72
26-Oct	82	80	84	43	23	68
27-Oct	78	76	80	39	19	64
28-Oct	76	74	78	37	17	62
29-Oct	77	75	79	38	18	63
30-Oct	75	73	77	36	16	61
31-Oct	73	71	75	34	14	59

With Base Projects Implemented: October

Because by October, neither IPID nor COIC are diverting, the two base projects that depend on their diversions are inapplicable in October (Table 6). Only the LNFH base project is operable in October--but its impact is nominal. Assuming the LNFH ceases the aquifer recharge diversion at RM 3.8, the historical channel has very low instream flows of below 40 cfs for all but three days in October. Without the results of the IFIM study, however, we cannot postulate what the impacts these month-long low flows would have on habitat.

To increase Icicle Creek's instream flow in October, further consideration must be given to potential projects that would reduce the LNFH's diversions and/or augment instream flow through releases from Snow/Nada lakes or any other controlled lakes in the Icicle Creek watershed. This released water must be specifically designated for augmenting instream flow.

Table 6. Instream flows during a low-flow October after three base projects implemented.

		Flow-affecting event (diversion or addition)			
	RM 5.8: Icicle Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 2 cfs (City)	RM 5.5: Plus 4 cfs (Snow Creek base flow)	RM 4.5 Minus 41 cfs (LNFH surface water diversion)	RM 2.8: Plus 41 cfs (LNFH surface water diversion)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Oct	70	68	72	31	72
2-Oct	68	66	70	29	70
3-Oct	67	65	69	28	69
4-Oct	66	64	68	27	68
5-Oct	65	63	67	26	67
6-Oct	65	63	67	26	67
7-Oct	65	63	67	26	67
8-Oct	65	63	67	26	67
9-Oct	69	67	71	30	71
10-Oct	68	66	70	29	70
11-Oct	67	65	69	28	69
12-Oct	69	67	71	30	71
13-Oct	75	73	77	36	77
14-Oct	76	74	78	37	78
15-Oct	77	75	79	38	79
16-Oct	74	72	76	35	76
17-Oct	73	71	75	34	75
18-Oct	71	69	73	32	73
19-Oct	70	68	72	31	72
20-Oct	70	68	72	31	72
21-Oct	74	72	76	35	76
22-Oct	73	71	75	34	75
23-Oct	77	75	79	38	79
24-Oct	79	77	81	40	81
25-Oct	86	84	88	47	88
26-Oct	82	80	84	43	84
27-Oct	78	76	80	39	80
28-Oct	76	74	78	37	78
29-Oct	77	75	79	38	79
30-Oct	75	73	77	36	77
31-Oct	73	71	75	34	75

Existing Conditions: December

As December's diversions are practically identical to October's, the question is whether there are some periods of sustained low flows that approach the very low flows of October. Due to increased precipitation, low ambient stream flows in Icicle Creek occur less frequently than in October, but the LNFH diversions in December are comparable to those in October. A constructed hydrograph for December reveals that there are eighteen days under 40 cfs, eight days under 30 cfs, and three under 20 cfs in the reach RM 3.8 to 2.8 (historical channel) (Table 5).

Table 7. Instream flow in Icicle Creek during existing conditions in a low-flow December (95% exceedence flow).

		Flow-affecting event (diversion or addition)				
	RM 5.8: Icicle Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 2 cfs (City)	RM 5.5: Plus 4 cfs (Snow Creek base flow)	RM 4.5 Minus 35 cfs (LNFH surface water diversion)	RM 3.8: Minus 20 cfs (LNFH aquifer recharge diversion)	RM 2.8: Plus 40 cfs (LNFH surface water diversion plus ground water use)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 3.8	RM 3.8 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Dec	106	104	108	73	53	93
2-Dec	105	103	107	72	52	92
3-Dec	105	103	107	72	52	92
4-Dec	105	103	107	72	52	92
5-Dec	102	100	104	69	49	89
6-Dec	101	99	103	68	48	88
7-Dec	99	97	101	66	46	86
8-Dec	97	95	99	64	44	84
9-Dec	88	86	90	55	35	75
10-Dec	84	82	86	51	31	71
11-Dec	82	80	84	49	29	69
12-Dec	64	62	66	31	11	51
13-Dec	62	60	64	29	9	49
14-Dec	66	64	68	33	13	53
15-Dec	77	75	79	44	24	64
16-Dec	77	75	79	44	24	64
17-Dec	81	79	83	48	28	68
18-Dec	82	80	84	49	29	69
19-Dec	84	82	86	51	31	71
20-Dec	83	81	85	50	30	70
21-Dec	90	88	92	57	37	77
22-Dec	89	87	91	56	36	76
23-Dec	89	87	91	56	36	76
24-Dec	88	86	90	55	35	75
25-Dec	87	85	89	54	34	74
26-Dec	87	85	89	54	34	74
27-Dec	94	92	96	61	41	81
28-Dec	97	95	99	64	44	84
29-Dec	97	95	99	64	44	84
30-Dec	96	94	98	63	43	83
31-Dec	93	91	95	60	40	80

With Base Projects Implemented: December

In the historical channel (RM 3.8 to 2.8), the average in December over the period studied was eight days below 50 cfs, three below 40 cfs, and one below 30 cfs.

Any additional projects that the stakeholder group considers to increase instream flow in October should be separately analyzed for December or later in winter.

Table 8. Instream flows during a low-flow December after three base projects implemented.

		Flow-affecting event (diversion or addition)			
	RM 5.8: Icicle Creek 95% exceedence flow @ USGS gage	RM 5.7: Minus 2 cfs (City)	RM 5.5: Plus 4 cfs (Snow Creek base flow)	RM 4.5 Minus 35 cfs (LNFH surface water diversion)	RM 2.8: Plus 35 cfs (LNFH surface water diversion)
	RM 5.8 to 5.7	RM 5.7 to 5.5	RM 5.5 to 4.5	RM 4.5 to 2.8	RM 2.8 to mouth (discounting accretion)
1-Dec	106	104	108	73	108
2-Dec	105	103	107	72	107
3-Dec	105	103	107	72	107
4-Dec	105	103	107	72	107
5-Dec	102	100	104	69	104
6-Dec	101	99	103	68	103
7-Dec	99	97	101	66	101
8-Dec	97	95	99	64	99
9-Dec	88	86	90	55	90
10-Dec	84	82	86	51	86
11-Dec	82	80	84	49	84
12-Dec	64	62	66	31	66
13-Dec	62	60	64	29	64
14-Dec	66	64	68	33	68
15-Dec	77	75	79	44	79
16-Dec	77	75	79	44	79
17-Dec	81	79	83	48	83
18-Dec	82	80	84	49	84
19-Dec	84	82	86	51	86
20-Dec	83	81	85	50	85
21-Dec	90	88	92	57	92
22-Dec	89	87	91	56	91
23-Dec	89	87	91	56	91
24-Dec	88	86	90	55	90
25-Dec	87	85	89	54	89
26-Dec	87	85	89	54	89
27-Dec	94	92	96	61	96
28-Dec	97	95	99	64	99
29-Dec	97	95	99	64	99
30-Dec	96	94	98	63	98
31-Dec	93	91	95	60	95

Discussion

The LNFH "base project" is a combination of on-site reuse, effluent pump-back and/or wellfield enhancements. This analysis only considers the effluent pump-back option because it removes LNFH's need to divert for aquifer recharge at RM 3.8. The water re-circulation or re-use option would allow the hatchery to divert 20 cfs less water at RM 4.5 and would result in greater instream flow benefits beginning at that point on the river. But those benefits might be wiped out at RM 3.8 if aquifer recharge diversion continues. The radial gates at Dam 2 are not precision instruments, and an assumption that the LNFH diverts only 20 cfs at RM 3.8 during low flow years may in fact be an underestimate. More precise data are required to evaluate the benefit of that option.

In any event, the three options listed under the LNFH base project, if implemented, would not collectively result in enough "saved" water to provide sufficient instream flow to Icicle Creek in low flow months (Table 9). In September, of course, the IPID and COIC projects would be helping instream flow, to the point where October is a much more critical low-flow month than September.

Table 9. Number of days below benchmark flows in RM 4.5 to RM 2.8 in low-flow months after base projects implemented.

Month / Flow	Days below 50 cfs	Days below 40 cfs	Days below 30 cfs
September	18	10	0
October	31	28	9
December	8	3	1

Even with implementation of the three base projects, this chart underscores that low flows continue to be a problem in September, October, and December. The benefits of the IPID- and COIC-related projects, moreover, cease on September 30th when the districts stop diverting. After that date, smaller diversions from LNFN or augmentation from storage (if feasible) are the only possible means to increase instream flows. Definite predictions for habitat cannot be made until the results of the IFIM study for the historical channel (RM 3.8 to 2.8) are available.